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Assessment of Social Welfare Progress of NEAZDP Beneficiaries in Yobe State of Nigeria

Abstract. Despite the implementation of the NEAZDP (North East Arid Zone Development Programme), the extent to which the program has improved the social welfare of its beneficiaries in Yobe State remains unclear, particularly in addressing income inequality, food security, and long-term socio-economic stability. Consequently, this study makes an attempt at assessing the social welfare progress of NEAZDP beneficiaries in Nigeria's Yobe State. Further, the study used undated household survey data of the year 2023, collected with the aid of a well-structured questionnaire coupled with an interview schedule from a total of 396 households (120 beneficiaries, and 138 each for the spillover and control groups). The households were selected through a multi-stage sampling technique and the collected data were subjected to inferential statistical analysis. Empirically, the NEAZDP had a notable impact on socio-economic development, income inequality, and social welfare among its beneficiaries. The program improved beneficiaries' socio-economic conditions, particularly in the areas of food security, asset acquisition, and wealth, while also reducing income inequality. However, the spillover group experienced even lower inequality, indicating strong indirect benefits. The analysis also revealed significant improvements in social welfare, particularly at the per capita income level, though food inflation negatively impacted both the beneficiaries and non-beneficiaries, exacerbating inequality. The findings suggest that while NEAZDP interventions effectively enhance economic stability and well-being, future strategies should focus on addressing internal disparities, mitigating inflationary pressures, and fostering long-term resilience in rural communities to sustain and deepen the program's positive outcomes.

Keywords: households, rural, programme, sustainability, welfare, Nigeria

JEL Classification: I31, I32, I38, J17

Introduction

Rural development remains a cornerstone for national economic progress (Ellis & Biggs, 2001; Oyedepo et al., 2020), particularly in developing countries where a significant portion of the population relies on agriculture for their livelihoods (World Bank, 2007; Nechifor et al., 2021; Idiku, 2024). In regions like sub-Saharan Africa, rural communities face persistent challenges, such as poverty (Komolafe et al., 2024; Musa & Mohammed, 2024), food insecurity, and income inequality, which undermine efforts towards sustainable development (Thorbecke, 2013; Nechifor et al., 2021). Governments and international organisations have implemented various rural development programmes aimed at addressing these issues by improving agricultural productivity (Shikur, 2020), creating income-generating opportunities, and enhancing social welfare (Kanbur & Squire, 1999; Teka & Lee, 2020; Salifu & Kufoalor, 2024). However, the success of such initiatives often

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varies, influenced by factors such as programme design, implementation, and local socio-economic conditions (Warinda et al., 2020; Sam et al., 2021; Schmidt et al., 2024).

Nigeria, the most populous country in Africa, exemplifies these challenges (Ucha, 2010; Aruofor & Ogbeide, 2024). Despite its vast agricultural potential, many rural communities in Nigeria face significant socio-economic disparities (Madu, 2010; Beegle et al., 2016; Ogbonna & Oji, 2020; Ayanwale et al., 2024). Poverty and income inequality are rampant, exacerbated by limited access to infrastructure, social services, and market opportunities (Deininger & Squire, 1998; Adams & Page, 2005; Ravallion, 2009; Adewuyi & Ogebe, 2019; Chinyoka, 2023). In response to these challenges, the Nigerian government, in collaboration with international development agencies, launched the North East Arid Zone Development Programme (NEAZDP) to drive rural economic transformation and improve the livelihoods of communities (United Nations Development Programme (UNDP), 2018), particularly in the north-east region.

While the NEAZDP was designed to boost agricultural productivity, raise household incomes, and improve living conditions, the extent to which it has addressed the core issues of income inequality and social welfare remains under-researched. The impact of such programmes not only on their direct beneficiaries but also on spillover communities, who indirectly benefit from the interventions, is also of interest in understanding the broader effectiveness of rural development initiatives.

Despite the implementation of the NEAZDP in rural areas of Nigeria's Yobe State, socio-economic challenges persist, including income inequality and limited social welfare improvements. While the program has shown potential in boosting agricultural productivity, questions remain regarding its overall impact on reducing income disparities and enhancing the social welfare of beneficiaries. Furthermore, it is unclear whether the programme's benefits have trickled through to non-participating communities via spillover effects, and how such outcomes compare to the control group. Without a thorough examination of these factors, the effectiveness of the NEAZDP in fostering equitable and sustainable development is uncertain.

This study is important because it provides empirical evidence on the socio-economic impact of the NEAZDP, with a focus on income inequality and social welfare. Understanding the successes and shortcomings of the NEAZDP will inform policymakers and stakeholders on how to enhance the design and implementation of rural development programmes. By assessing both the direct and spillover effects, this study aims to provide a comprehensive evaluation of the programme's reach and influence. Moreover, given the rising concern over food inflation and its impact on rural communities, this study will contribute valuable insights into how external economic factors, such as inflation, affect the social welfare of the beneficiaries. The findings will help shape future rural development strategies that promote inclusive growth, reduce income disparities, and improve the well-being of rural populations in the study area in particular, as well as in Nigeria and beyond. Consequently, this study aimed to assess the social welfare progress of NEAZDP beneficiaries in the Yobe State of Nigeria. The specific objectives were to assess the impact of the programme on the socio-economic development status of the beneficiaries, to assess the impact of the programme on the income inequality of the beneficiaries, and, to determine the influence of the programme on the social welfare of the beneficiaries.

Research methodology

Yobe State is located between latitudes 10°30'N and 13°30'N and longitudes 11°00'E and 13°30'E in northeastern Nigeria (Umar, 2024). The state is bordered by Niger Republic to the north, and other Nigerian states such as Borno, Jigawa, and Bauchi. The State has an arid-to-semi-arid climate, characterised by low and irregular rainfall, high temperatures, and frequent droughts, which contribute to desertification and limit agricultural productivity. The State receives an annual rainfall amount ranging between 500 mm and 1,000 mm, with most of the rain occurring between June and September. The temperature in the state typically ranges from 30°C to 40°C but can occasionally reach higher levels during the dry season. The humidity levels are generally low, averaging between 20% and 40%, reflecting the arid and semi-arid climate of the region. Given the Sahelian location of the state, its agro-ecological conditions are dominated by sparse vegetation, sandy soils, and limited water resources, making rain-fed subsistence farming and livestock rearing the predominant primary economic activities of the rural communities (Madaki et al., 2024).

The state experiences significant socio-economic challenges, including high levels of poverty, income inequality, food insecurity, and limited access to basic services such as healthcare, education and infrastructure, and recurring conflicts due to insurgency. These challenges are exacerbated by periodic environmental shocks, such as droughts and desertification, which threaten agricultural productivity. These factors make Yobe an ideal location for development programmes such as the NEAZDP, which aims to alleviate poverty and promote sustainable socio-economic growth. The programme's interventions in agriculture, income generation, and social services are critical in addressing the systemic underdevelopment that characterises the region. In other words, the NEAZDP targets this region to enhance agricultural productivity, improve rural livelihoods, and foster socio-economic development through infrastructure development, capacity-building initiatives, and livelihood diversification programs. The state is a crucial focus of this study due to its significant vulnerability to environmental stressors, as well as its need for sustained development interventions to improve the socio-economic welfare of its population. It is also a given that, with a relatively low literacy rate and weak institutional capacity, the effectiveness of rural development programmes in improving social welfare and reducing poverty is crucial for the state's long-term growth. Given its socio-economic profile, Yobe State provides a relevant setting for assessing the impact of the NEAZDP on social welfare and income inequality among rural beneficiaries.

Using a multi-stage sampling technique, a total of 396 respondents were randomly selected from three targeted populations for the study. The targeted populations were treated (project participating sites), spillover, and control units (Figure 1). It should be noted that the programme is confined to the northern part of the state and covered only nine (9) Local Government Areas (LGAs): Bade, Jakusko, Bursari, Geidam, Yunusari, Yusufari, Nguru, Karasuwa, and Machina. Firstly, to ensure balance across the sampling units, of the nine (9) treated LGAs, four (4) LGAs – Bade, Jakusko, Bursari, and Geidam – were randomly selected. Next, four (4) LGAs each for the spillover and control groups – Tarmuwa, Nangere, Fune, and Fika for the spillover group, and Damaturu, Potiskum, Gujba, and Gulani for the control group – were purposively selected because the former fell within the radius of 20–50 km while the latter fell within the radius of greater than or equal to 100 km, as adopted by Sadiq et al. (2020).

Furthermore, given the peculiarity of the treated sites, from each of the four (4) selected treated LGAs, one (1) Development Area (DA) was selected and thereafter a random selection was made of three (3) clusters from each of the selected DAs, thus giving a total of twelve (12) selected clusters. Moreover, from each of the selected clusters – treated units, spillover, and control units respectively, two (2) villages were randomly selected, thus giving a total of forty (40) randomly selected villages. Lastly, using a sampling frame obtained from the NEAZDP coupled with a reconnaissance survey (Table 1), from each of the selected programme villages, five (5) out of a total of fifteen (15) beneficiaries were randomly selected, thus giving a total of one hundred and twenty (120) randomly selected beneficiaries. However, given the non-availability of a finite sample frame for the non-beneficiary group, the sample size was generated using the error margin formula as proposed by Bartlet et al. (2002) (Equation 1). Generally, a total of three hundred and ninety-six (396) respondents from the treated (120), exposed (138) and control (138) groups selected at random constituted the sample size for this study (Table 1). Further, using an easy-route cost approach, a well-structured questionnaire complemented with an interview schedule was used by trained enumerators to elicit cross-sectional data in the year 2023. Nevertheless, the first objective was achieved using the socio-economic index; the second and third objectives were achieved using inequality (S-Gini and Entropy) and social welfare indexes (Atkinson).

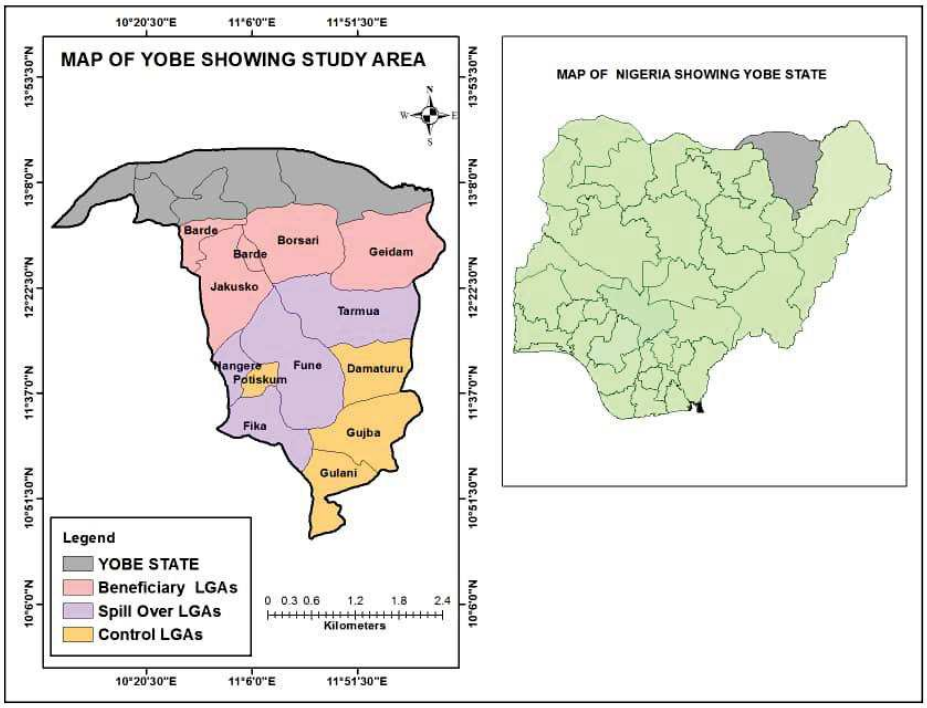

Fig. 1. Map of the study area

Source: Authors' own design, 2023.

Table 1. Sampling Frame of both the beneficiaries and non-beneficiaries

Category	LGAs	DAs	Cluster villages	Villages	SF	SS
Beneficiary	**Treatment**					
	Bade	Dagona	Dala	Gabarwa	15	5
				Mainiya	15	5
			Tagali	Lafiyami	15	5
				Madamuwa	15	5
			Bizi	Murza	15	5
				Misilli	15	5
	Bursari	Dumburi	Dadigar	Baya mallum	15	5
				Diga	15	5
			Gadine	Gamsa West	15	5
				Gamsa East	15	5
			Daskum	Gangawa	15	5
				Kagadama	15	5
	Geidam	Balle	Bayamari	Malango	15	5
				Kelluri	15	5
			Damaya	Mobarti	15	5
				Gallaba	15	5
			Ajiri Dapchi	Ajiri Geidam	15	5
				Matakuskum	15	5
	Jakusko	Muguram	Jaba	Dagayak	15	5
				Garin maji	15	5
			Gamjam	Nasari	15	5
				Garin Tsaiha	15	5
			Lafiya loiloi	Buduwa	15	5
				Gamya	15	5
Sub- total	**4**	**4**	**12**	**24**	**360**	**120**
Non-Beneficiary	**Spillover**					
	Tarmuwa	-	-	Lantewa	-	17
				Biriri	-	17
	Nangere	-	-	Dawasa	-	17
				S/Gari Nangere	-	17
	Fune	-	-	Dogon Kuka	-	17
				Damagum	-	17
	Fika	-	-	Janga	-	18
				Gadaka	-	18
	4	**-**	**-**	**8**	**-**	**138**
	Control					
	Damaturu	-	-	Maisandari	-	17
				Dukumari	-	17
	Gujba	-	-	Katarko	-	17
				Kasesa	-	17
	Gulani	-	-	Bara	-	17
				Shishiwaji	-	17
	Potiskum	-	-	Mamudo	-	18
				Garin Jaji	-	18
	4	**-**	**-**	**8**	**-**	**138**
Total	**12**	**4**	**12**	**40**		**396**

Source: NEAZDP report (2022) and Reconnaissance survey (2022).

According to Bartlett's formula, the sample size of the unknown can be generated using the following formula:

$$N_{nb} = Z^2 * P(1-P)/e^2 \text{ .... (1)}$$

Where, N_{nb} is the sample size of the non-beneficiaries, Z is the Z-statistic at 5% probability level (1.96), P is the sample proportion (10%), and e is the error gap at 5%.

Empirical model

Socio-economic Index

Socio-economic status may be indicated by various factors such as educational attainment, occupational standing, social class, income (or poverty), wealth, and tangible possessions, such as home appliances or libraries, houses, vehicles owned, etc. All these qualitative and quantitative indicators need to be captured to obtain precise socio-economic indexes. The Socio-economic Index is a product on the basis of which the welfare of the target groups or communities can be assessed and compared.

a) Quantitative indicators

1. Annual per capita income (₦)
2. Annual per capita expenditure on food (₦)
3. Annual per capita non-food expenditure (₦)
4. Annual per capita value of productive assets (land, livestock, and machinery) (₦)
5. Rooms per person (No.)
6. Annual per capita expenditure on education (₦)
7. Percent of children enrolled in primary education (age group 5–14 yrs)
8. Per capita annual expenditure on health (₦)
9. Liabilities in the form of per capita amount of outstanding debt (₦)

b) Qualitative indicators

10. Access to health facilities such as safe drinking water, sanitation.
11. Condition of the dwelling house (depends on material used for making the houses).
12. Possession of other assets (bicycle, mobile phone, T.V. (both black and white and colour), electric fan, CD player, emergency lamp, etc.).

The changes in the value of these indicators will be examined in the given period. The inflationary effect should be eliminated from the values of those variables that are expressed in monetary term using the Consumer Price Index (CPI).

For this, a continuum point scale will be prepared for socio-economic indicators depending upon the variability of the selected indicators by using the formula below:

$$Mean \pm 0.5 * Standard\ deviation \text{ .... (2)}$$

Scale value 1: $\leq Mean - 0.5 * SD$; Scale value 2: $> Mean - 0.5 * SD$; Scale value 3: $> Mean + 0.5 * SD$

$I_{ij} = \sum S_{ijk} / Maximum\ Possible\ Total\ Scale\ Value * 100$ .... (3)

I_{IJ}= Socio-economic index of the i^{th} beneficiary in the j^{th} period;

s_{IJ} = Scale value of the kth indicator of the i^{th} beneficiary in the j^{th} period.

Based on index value, the total sample can be grouped into 3 different socio-economic strata: poor socio-economic condition: $\leq Mean - 0.5 * SD$; moderate socio-economic

condition: $> Mean - 0.5 * SD\ to \leq Mean + 0.5 * SD$; and, good socio-economic condition: $> Mean + 0.5 * SD$ using the same principle (Equation 2).

Decomposition of the S-Gini index of inequality

Let J components y^j add up to y, that is:

$$y_i = \sum_{j=1}^{J} y_i^j \quad \text{.....(4)}$$

We can decompose the S-Gini index of inequality as follows:

$$I(\rho) = \sum_{j=1}^{J} \frac{\mu_j}{\mu} I C_j(\rho) \quad \text{..... (5)}$$

The contribution of the j^{th} component to inequality in y is $\frac{\mu_j}{\mu_y} I C_j(\rho)$

Where $I C_j(\rho)$ is the coefficient of concentration of the j^{th} component and μ_j is the mean of that component.

Decomposition of the Generalised Entropy index of inequality

The Generalised Entropy index of inequality can be decomposed as follows:

$$I(\theta) = \sum \phi(k) \left[\frac{\mu(k)}{\mu_y} \right]^{\theta} .I(k:\theta) + \bar{I}(\theta) \quad \text{..... (6)}$$

where:

$\phi(k)$ is the proportion of the population found in subgroup k; $\mu(k)$ is the mean income of group k; $I(k;\theta)$ is the inequality within group k, and $\bar{I}(\theta)$ is population inequality if each individual in subgroup k is given the mean income of the subgroup.

Inequality dominance

The distribution dominates distribution in inequality at order s over the conditional range of proportions of the mean $\left[1^-, 1^+\right]$ only if $\overline{P}_1(\lambda \mu_1, \alpha) > \overline{P}_2(\lambda \mu_2, \alpha) \quad \forall\ \lambda \in \left[1^-, 1^+\right]$.

Where $\alpha = s - 1$. This application checks for the points at which there is a reversal of the above dominance conditions for inequality orderings. Put differently, it provides the crossing points of the FGT curves; that is, the values of λ and $\overline{P}_1(\lambda \mu_1, \alpha)$, for which $\overline{P}_1(\lambda \mu_1, \alpha) = \overline{P}_2(\lambda \mu_2, \alpha)$ when

$$(\overline{P}_1((\lambda - \eta)\mu_1, \alpha) - \overline{P}_2((\lambda - \eta)\mu_2, \alpha)) = sign(\overline{P}_2((\lambda - \eta)\mu_2, \alpha) - \overline{P}_1((\lambda - \eta)\mu_1, \alpha))$$

for a small η.

Atkinson-Gini index

Denoting the Atkinson-Gini index of inequality for the group k by $I(k;\varepsilon,\rho)$, and the S-Gini social welfare index by $\xi(k;\varepsilon,\rho)$, we have (Singh & Shrotryia, 2022; Bigsten, 2024; Sadiq & Sani, 2024; Zou, 2024):

$$I(k;\varepsilon,\rho)=\frac{\mu(k)-\xi(k;\varepsilon,\rho)}{\mu(k)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

where:

$$\xi(k;\varepsilon,\rho)=\begin{cases}\left[\sum_{i=1}^{n}\left[\frac{(V_i)^{\rho}-(V_{i+1})^{\rho}}{(V_1)^{\rho}}\right](y_i)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} \rightarrow \varepsilon\neq 1,\varepsilon\geq 0 and \rho\geq 1 \\ Exp\left[\sum_{i=1}^{n}\left[\frac{(V_i)^{\rho}-(V_{i+1})^{\rho}}{(V_1)^{\rho}}\right]\ln(y_i)\right] \rightarrow \varepsilon=1 and \rho\geq 1\end{cases} \quad \ldots\ldots\ldots\ldots(8)$$

and:

$$V_i=\sum_{h=i}^{n} w_h^k$$

Impact of a price change on the Atkinson Social Welfare Index

The impact of good 1's marginal price change (denoted IMPW) on the Atkinson Social Welfare index $\xi(\varepsilon)$ is as follows:

$$IMPW=\frac{\partial\xi(\varepsilon)}{\partial p_1}*pc \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

$$IMPW=\begin{cases}-(s1)^{\frac{1}{\varepsilon-1}}*(s2)^{\frac{\varepsilon}{1-\varepsilon}}*(s3)*pc if\varepsilon\neq 1 \\ -\exp(s2/s1)*s3/s1*pc if\varepsilon=1\end{cases}$$

$$\begin{cases}s1=\sum_i w_i\, s2=\sum_i w_i y_i^{1-\varepsilon}\, s3=\sum_i w_i y_i^{-\varepsilon} x_i if\varepsilon\neq 1 \\ s1=\sum_i w_i\, s2=\sum_i w_i\log(y_i) s3=\sum_i w_i x_i/y_i if\varepsilon=1\end{cases}$$

Where x_i^1 is the expenditure on commodity 1 by individual i, y_i is the variable of interest ('living standard'), and pc is the percentage price change for good l.

Tax reform

This tax reform consists of a variation in the prices of two commodities 1 and 2, under the constraint that it leaves total government revenue unchanged. The effect of this constraint is given by an efficiency parameter, 'gamma' (γ), which is the ratio of the marginal cost of public funds (MCPF) from a tax on 2 over the MCPF from a tax on 1.

The impact of this tax reform (denoted IMWTR) on the Atkinson Social Welfare index $\xi(\varepsilon)$ is as follows:

$$IMWTR = \left[\frac{\partial \xi(\varepsilon)}{\partial p_1} - \gamma \frac{\overline{X}_1}{\overline{X}_2} \frac{\partial \xi(\varepsilon)}{\partial p_2}\right] * pc \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(10)}$$

Where pc is the percentage price change of commodity 1, and $\overline{X}_g$ is the total expenditure on the good g. Under the government revenue constraint, the percentage price change of commodity 1 is given by $\gamma \frac{\overline{X}_1}{\overline{X}_2} pc$.

Decomposition of variation of social welfare index between two periods

We can decompose the difference in social welfare (as measured by the EDE Atkinson index) between two populations, 1 and 2, as follows:

$$\xi_2(\varepsilon) - \xi_1(\varepsilon) = \underbrace{(I_1 - I_2) * \mu_1}_{C1} + \underbrace{(\mu_2 - \mu_1) * (1 - I_1)}_{C2} + \underbrace{(\mu_2 - \mu_1) * (I_2 - I_2)}_{C3} \quad \ldots\ldots \text{(11)}$$

Where C1 = Impact of change in inequality, C2 = Impact of change in mean, and C3 = Interaction impact.

Results and discussion

Impact of NEAZDP on Socio-economic Development Status of Beneficiaries

Individual-wise, the results in Table 2a revealed the socio-economic development status of the households (beneficiaries) before the programme to be 15.8%, while 16.7% was observed after the programme, thus indicating a good improvement in the socio-economic development of the beneficiaries after participating in the programme. Besides this, before participation in the programme, 28.3 and 55.8%, respectively, of the beneficiaries had poor and moderate socio-economic development status, while after participating in the programme, 32.5 and 50.8% of the beneficiaries had poor and moderate socio-economic development status, respectively (Table 2a). To sum up, the proportion of the households with good socio-economic development slightly increased by 0.9%, whereas the proportions of the households with moderate and poor socio-economic development levels, respectively, gently plummeted by 5% and 4.2%.

Table 2a. Distributions of the socio-economic development status of the beneficiaries

Status	Before	After
Poor	39(32.5)	34(28.3)
Moderate	67(55.8)	61(50.8)
Good	19(15.8)	20(16.7)
Total	120(100.0)	120(100.0)

Note: Figures in parentheses are percentages.

Source: Field survey, 2023.

Generally, the radar-wise distribution (Figure 1a) of the socio-economic development (SED) of the beneficiaries showed the group to have a high endowment of moderate and good socio-economic statuses relative to the poor level of development after participating in the developmental intervention of NEAZDP activities compared to before participating in the programme. This implies that the socio-economic status of the programme beneficiaries improved after participating in the programme; despite improvement, there was variation, as a slight percentage progressed up to the good level in order to maintain a balance, as is evident in Figure 1a.

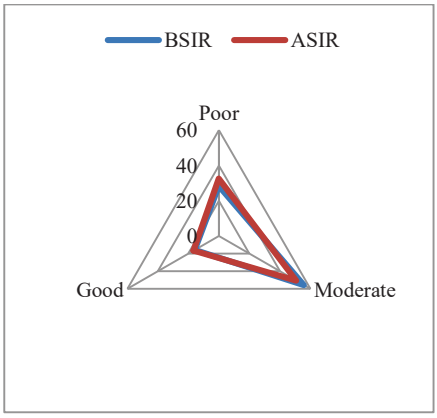

Fig. 1a: SED before (BSIR) and after (ASIR)

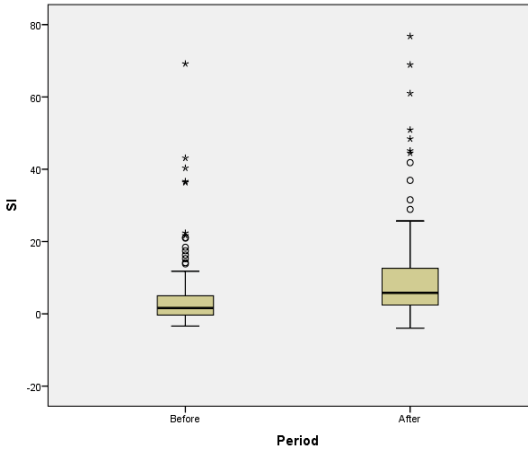

Fig. 1b: Average SED of the beneficiaries

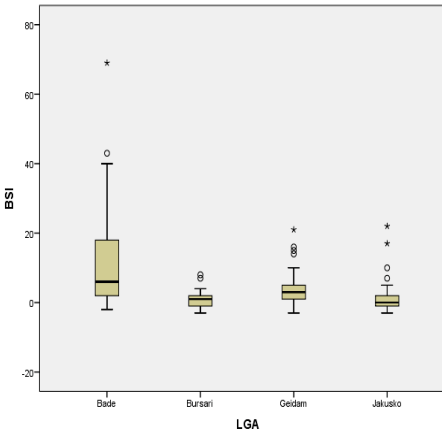

Fig. 1c: Beneficiary LGAs before participation

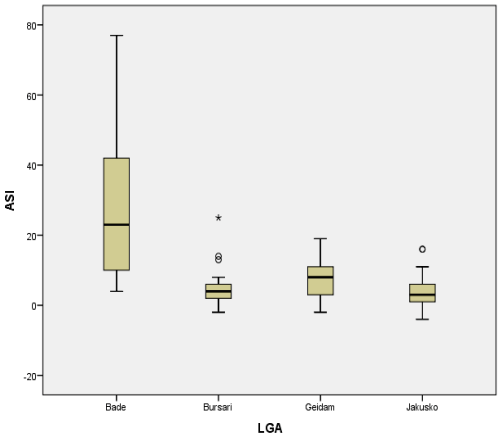

Fig. 1d: Beneficiary LGAs after participation

Source: Authors' own research.

Further, as depicted by the box plot (Figure 1b), a large proportion of the beneficiaries were above the average buffer threshold of socio-economic development after programme participation, compared to the minimal proportion before participation in the programme. Further, after participating in the programme, the internal differences in the socio-economic

development status of the beneficiaries with fair status were large compared to before participation, where the differences in the development status of the beneficiaries with fair status were minimal. However, the possible reason for large internal differences in the socio-economic development was due to spatial effects of the targeted beneficiary LGAs (Local Government Areas), as depicted by the box plot in Figures 1c and 1d.

Indicator-wise, fortunately, the beneficiaries' socio-economic development status with respect to monthly per capita expenditure on food items after programme participation maintained a status quo of a good level, as is evident by its respective index values (Table 2b and Figure 1e). The status quo of a good socio-economic development status suggests that the programme effectively sustained or improved food security outcomes. This could be due to increased agricultural productivity, leading to greater food availability and affordability within the households. Additionally, the improved annual income from agricultural activities may have allowed households to maintain or enhance their food consumption levels, thereby supporting stable socio-economic conditions related to food expenditure.

With respect to the monthly per capita expenditure on non-food items, annual per capita value of productive assets, and wealth index (equipment), the socio-economic development level of the beneficiaries after programme participation progressed to a good status, as indicated by their respective index values. The progression could be attributed to the programme's effective enhancement of agricultural productivity and annual income. This likely led to increased disposable income, allowing households to invest in non-food items, productive assets, and improved household equipment, thereby raising their overall wealth and socio-economic status.

Conversely, the socio-economic development status of the beneficiaries with respects to monthly per capita income and number of children enrolled in primary education (5–14 years age) retrogressed to a moderate level after programme participation. The retrogression could stem from the programme's focus on short-term agricultural gains without sustainable support and follow-up mechanisms for market integration, education quality, or resilience to environmental challenges in the study area. This may have led to a lapse in income growth and educational opportunities post-programme, limiting long-term socio-economic progress for the participating households.

Further, the socio-economic development status of the beneficiaries after programme participation with respects to annual per capita expenditure on education and monthly per capita expenditure on health maintained a status quo of a moderate level. The status quo of a moderate socio-economic development level for the aforementioned indicators could be due to the limited direct focus or impact of the programme on these specific socio-economic indicators. The NEAZDP might primarily enhance agricultural productivity and income, with less direct influence on educational and health expenditures. Thus, while there may be indirect benefits to education and health from improved overall annual income, the programme may not have provided targeted interventions or support mechanisms directly addressing these areas to elevate them to a higher development level.

Unfortunately, with respect to total number(s) of room(s) in the household, number(s) of room(s) per person in the household, and TLU (Tropical livestock unit), the socio-economic development status of the beneficiaries after programme participation remained poor, as is evident by their respective index values. The status quo of the poor level of socio-economic development of the aforementioned indicators could be due to the

programme's limited focus on improving housing conditions and livestock management. The NEAZDP may have prioritised agricultural productivity without addressing broader household infrastructure and livestock management practices. As a result, these socio-economic indicators related to housing quality and livestock assets may not have improved significantly, leaving households at a poor level of development in these respects.

Table 2b. Indicator-wise distributions of socio-economic development status of the beneficiaries

Indicators	Before	Level	After	Level
Monthly per capita income (₦)	4.895796	3	5.171215	2
Monthly per capita expenditure on food (₦)	6.796116	3	10.9111	3
Monthly per capita non-food expenditure (₦)	3.049017	2	10.17327	3
Annual per capita value of productive assets (₦)	0.409084	2	9.636384	3
Annual per capita expenditure on education (₦)	2.159468	2	3.999434	2
No. of children enrolled in primary education (age group 5-14 yrs)	6.519375	3	6.472222	2
Total number of rooms in the house	−3.56889	1	−0.57333	1
Number of rooms per person in the house	−9.75917	1	−12.225	1
Monthly per capita expenditure on health (₦`)	3.439565	2	6.387923	2
Wealth index (equipment)	3.259286	2	11.60336	3
TLU	−1.25948	1	−6.28669	1

Note: Levels 1, 2 and 3 are poor, moderate and good socio-economic status, respectively (see Equation 2).

Source: Field survey, 2023.

Generally, it can be inferred that programme participation brought about an improvement in the socio-economic development status of the beneficiaries in terms of expenditures on food, non-food items, value of productive assets, and wealth index. Besides, for the deficits indicators, the programme could enhance them in the study area by integrating livelihood diversification with agricultural productivity. It should offer training in improved farming techniques and provide access to markets for increased income. Livestock management training and veterinary services can also boost the TLU. Income gains can fund housing improvements, while education campaigns can raise awareness about children's enrolment. Funding should improve school facilities and provide scholarships; likewise, health education and subsidised services can decrease health costs. Also, continuous monitoring and community involvement are crucial for sustainable socio-economic development and improved living conditions.

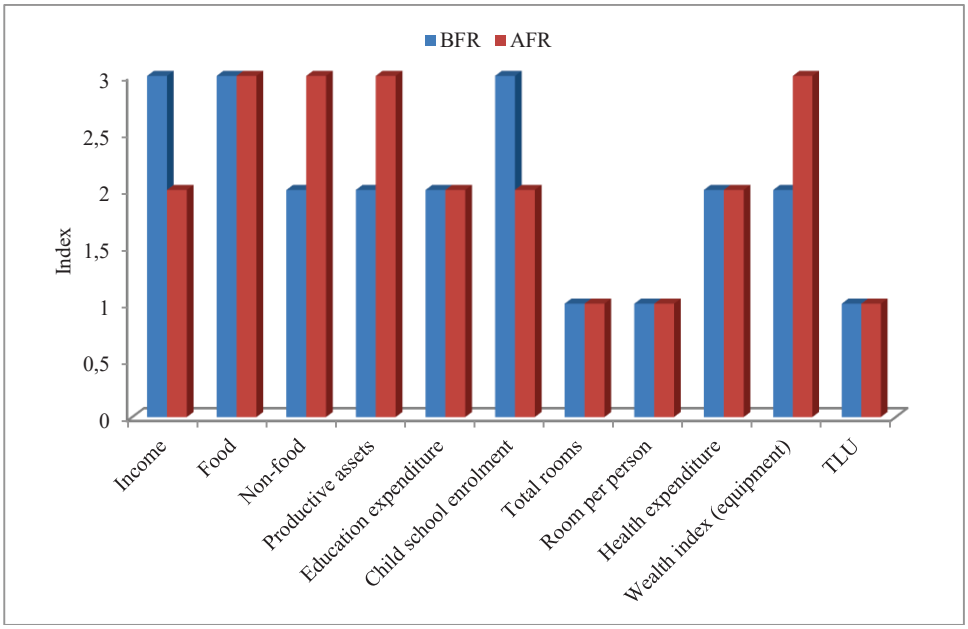

Fig. 1e. Indicator-wise distributions of socio-economic development index

Source: Authors' own research.

Moreover, the empirical evidence shows that the socio-economic development status of the beneficiaries after participating in the programme increased by 5.74%, as indicated by the significance of the mean value (−0.05744) at a 1% probability level (Table 2c). Besides, the highest and lowest programme impacts on the socio-economic development status of the beneficiaries were 7.16 and 4.334%, respectively. Thus, it can be inferred that the programme had an impact on the socio-economic status of the beneficiaries. Succinctly, the positive impact of the programme on the socio-economic development status in the study area implies improved livelihoods, economic resilience, food security, and overall well-being of the beneficiaries. Furthermore, it signifies progress towards achieving the relevant sustainable development goals at the local level, contributing to broader regional and national development efforts in Nigeria.

Table 2c. Impact of the programme on the socio-economic development level of the beneficiaries

Item	Paired Differences					t-stat
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
BFSI - AFSI	−0.05744	0.07801	0.00712	−0.07155	−0.04334	-8.067***

Note: BFSI = Before socio-economic index; AFSI = After socio-economic index; *** means significant at a 1% probability level.

Source: Field survey, 2023.

Impact of NEAZDP on Income Inequality of Beneficiaries

In assessing the impact of the NEAZDP on the state of income inequality between the beneficiary and spillover groups (analytical approach) (Table 3a), the results showed a low level of income inequality across the both groups, as evident by the estimated S-Gini index of 0.264 and 0.216 for the former and latter. However, the state of income inequality of the spillover group is lower than that of the beneficiary group, thus indicating the presence of a spillover effect despite the absence of an intervention in the former. Furthermore, for the beneficiary group, the magnitude of the income difference between its sub-groups accounted for a 5.36% variation in the low-income inequality (as evident by the absolute contribution index), whereas the proportional income difference between its sub-groups accounted for a 22.34% variation (as evident by the relative contribution index) in the low-income inequality. Likewise, for the spillover group, absolute and relative contributions, respectively, accounted for 6.52 and 27.18% of the variations in the low-income inequality. Generally, between the groups, the absolute and relative contributions, respectively, accounted for 2.06 and 8.57% of the variations in the low-income inequality. Further, within the groups, the absolute and relative contributions, respectively, accounted for 11.88 and 49.52% of the variations in the low-income inequality. Nevertheless, for the interaction/overlap effect, the absolute and relative contributions to the low-income inequality are in the proportion of 10.05 and 41.91%, respectively. It is noteworthy that the effects of the endowment (i.e., socio-economic attributes) outweigh that of the structural effect (intervention/programme) in dousing the level of income inequality. Though not closely related, the Shapley approach exhibited a similar pattern with respect to the effects of absolute and relative contributions on income inequality (Table 3b). Succinctly, the results suggest that while the NEAZDP has successfully reduced income inequality among the beneficiaries, the lower inequality in the spillover group highlights significant spillover effects, indicating that socio-economic endowments, rather than the program intervention itself, play a more substantial role in reducing inequality. Future policies should focus on addressing internal disparities within the beneficiary group and improving socio-economic conditions to enhance the program's long-term impact.

On the other hand, despite having a level of low-income inequality across the groups (i.e., beneficiary versus control groups) (Table 3a), the status of the beneficiary group (0.264) is lower than that of the control group (0.297), thus indicating that the programme had a significant impact on reducing the state of income inequality among the beneficiary group. Further, referencing the beneficiary group, the absolute and relative contributions, respectively, accounted for 6.35 and 22.18% of the variations in its sub-group(s)' low-income inequality. Likewise, referencing the control group, the proportions of the absolute and relative contributions, respectively, to the low-income inequality of its sub-group are 7.67 and 26.79%. Generally, between the groups, the proportions of absolute and relative contributions, respectively, to the low income inequality are 5.09 and 17.80%. Besides, within the groups, the proportions of the absolute and relative contributions to the low income inequality are 14.02 and 48.97%, respectively. Nevertheless, for the overlap effect, the proportions of absolute and relative contributions to the low income inequality are 9.51 and 33.23%, respectively. Succinctly, the results imply that the NEAZDP significantly reduced the income inequality among the beneficiary group compared to the control group.

Thus, it can be inferred that the low-income inequality in this population is owed largely to the endowment effect. However, the predominant role of endowment factors in driving the low income inequality suggests that improving the socio-economic conditions, rather than the program's direct interventions alone, will be key to further reducing inequality in the region.

Table 3a. S-Gini inequality decomposition (Analytical decomposition approach)

Group #	Estimated S-Gini	Population Share	Income Share	Absolute Contribution	Relative Contribution
Beneficiary vs. Spillover					
1	0.26396156	0.44038858	0.46095258	0.05358374	0.22337214
2	0.21615615	0.55961142	0.53904743	0.06520504	0.27181735
Within-Group	-	-	-	0.11878877	0.49518949
Between-Groups	-	-	-	0.02056400	0.08572425
Overlap	-	-	-	0.10053271	0.41908626
Beneficiary vs. Control					
1	0.26396156	0.46560847	0.51655510	0.06348604	0.22182732
3	0.29677328	0.53439153	0.48344489	0.07667104	0.26789719
Within-Group	-	-	-	0.14015707	0.48972451
Between-Groups	-	-	-	0.05094664	0.17801328
Overlap	-	-	-	0.09509203	0.33226221
Pool					
1	0.25184801	0.28030600	0.30486549	0.02152183	0.08547546
2	0.20837571	0.39403407	0.40684225	0.03340465	0.13266892
3	0.28608882	0.32565992	0.28829226	0.02685952	0.10667446
Within-Group	-	-	-	0.08178599	0.32481885
Between-Groups	-	-	-	0.04345473	0.17258354
Overlap	-	-	-	0.12654883	0.50259761

Source: Field survey, 2023.

Furthermore, for the pool results, the income inequality across the groups (beneficiary versus spillover and control groups) is low, with the spillover group being the least, followed by the beneficiary group and then the control group (Table 3a). Surprisingly, the absolute and relative contributions of the beneficiary and control groups to reducing income inequality are low compared to that of the spillover group. It is noteworthy that the contributory parameter estimates of the control group are higher than that of the beneficiary group. Thus, it can be inferred that the programme intervention helped to even-out the income inequality among the beneficiary group in the study area. Nevertheless, the result of the Shapley approach is in line with that of the Analytical approach (Table 3b). Moreover, for the overall population, the level of income inequality is low (0.2518); between the groups, the difference in the incomes of the three groups is responsible for a 4.35% decrease in income inequality, whereas the difference in the proportions of the groups' incomes is responsible for a 17.26% decline in the income inequality of the population. Furthermore, within the population, the absolute and relative contributions, respectively, accounted for 8.18 and 32.48% decreases in income inequality of the population. Nevertheless, the interaction/overlapping effect of the decreasing income inequality with

reference to the absolute and relative contributions, respectively, are 12.65 and 50.26%. Further, in validation of the S-Gini decomposition, the Entropy inequality decomposition results follow the same pattern (Table 3c), thus justifying the states of inequality between the beneficiary versus spillover and control groups in the study area. Therefore, it can be inferred that the NEAZDP effectively reduced the income inequality among the beneficiary group, but the spillover group experienced an even lower inequality, suggesting strong indirect benefits from the program. Despite this, the programme helped equalise the income distribution within the beneficiary group, and the validation through Entropy decomposition confirms the robustness of these findings, emphasising the programme's positive impact on reducing inequality in the region.

Table 3b: S-Gini inequality decomposition (Shapley's decomposition approach: inter vs. intra)

Variable	Beneficiary vs. Spillover	Beneficiary vs. Control	Pool
Estimated S-Gini	0.23988549	0.28619575	0.25178956
Estimated S-Gini (mu_g)	0.02056400	0.05094664	0.04345473
Estimated S-Gini (y_i*(mu/mu_g))	0.23907227	0.28198872	0.24867037

Source: Field survey, 2023.

Table 3b: Continued …. (First Stage: Decomposition to the Inter & Intra-Group Components)

Contribution #	Absolute	Relative
		Beneficiary vs. Spillover
Inter-Group	0.01068861	0.04455714
Intra-Group	0.22919688	0.95544286
		Beneficiary vs. Control
Inter-Group	0.02757684	0.09635657
Intra-Group	0.25861891	0.90364343
		Pool
Inter-Group	0.02328696	0.09248581
Intra-Group	0.22850260	0.90751419

Source: Field survey, 2023.

Table 3b: Continued …. Second Stage: Decomposition of the Intra-Group Component

Group #	Estimate Contribution	Relative Contribution
		Beneficiary vs. Spillover
1	0.11772724	0.49076431
2	0.11146963	0.46467850
		Beneficiary vs. Control
1	0.11320091	0.39553666
3	0.14541802	0.50810682
		Pool
1	0.06878078	0.27316773
2	0.07359806	0.29229990
3	0.08612375	0.34204656

Source: Field survey, 2023. Note, 1, 2 & 3 mean beneficiary, spillover and control groups respectively.

Table 3c: Entropy inequality decomposition

Variable	Beneficiary vs. Spillover	Beneficiary vs. Control	Pool
Total inequality	0.10471230	0.13580564	0.11257414
	(0.01296421)	(0.01243298)	(0.01523804)
Between group inequality	0.00085958	0.00519326	0.00353491
	(0.00001170)	(0.00002351)	(0.00208952)
Within group inequality	0.10385271	0.13061237	0.10903924
	(0.03022355)	(0.03163589)	(0.00708623)
Population Mean	15458.09535758	14584.12540242	13950.92389785
	(427.78152473)	(483.15434141)	(789.89840003)

Notes: Value in ( ) is the standard error.

Source: Field survey, 2023

Table 3c: Continued …….

Group #	Estimate	Normalised Mean	Population Share	Absolute Contribution	Relative Contribution
			Beneficiary vs. Spillover		
1	0.11386526	1.00000000	0.44038858	0.05014496	0.47888320
	(0.01635559)	(0.00000000)	(0.03193037)	(0.00793170)	(0.06668043)
2	0.09598447	1.00000000	0.55961142	0.05371401	0.51296752
	(0.01839555)	(0.00000000)	(0.03193037)	(0.01071693)	(0.06684438)
			Beneficiary vs. Control		
1	0.11386526	1.00000000	0.46560847	0.05301663	0.39038606
	(0.01635535)	(0.00000000)	(0.03233520)	(0.00831939)	(0.05014324)
3	0.14520080	1.00000000	0.53439153	0.07759408	0.57136125
	(0.01665229)	(0.00000000)	(0.03233520)	(0.00993132)	(0.05507303)
			Pool		
1	0.10198310	1.00000000	0.28030600	0.02858648	0.25393465
	(0.01593413)	(0.00000000)	(0.33943272)	(0.03908157)	(0.34130039)
2	0.09295407	1.00000000	0.39403407	0.03662707	0.32535952
	(0.00378225)	(0.00000000)	(0.38837504)	(0.03759018)	(0.37458976)
3	0.13455114	1.00000000	0.32565992	0.04381791	0.38923604
	(0.01301139)	(0.00000000)	(0.32955313)	(0.04856712)	(0.38787333)

Notes: Value in ( ) is the standard error.

Source: Field survey, 2023.

Impact of NEAZDP on Income Inequality Dominance of Beneficiaries

In assessing the state of inequality dominance across the targeted groups (Table 4), the results of the beneficiary versus spillover groups showed inequality to be dominant in the beneficiary group compared to the spillover group at cross points 1 versus 2. For the beneficiary group, a significant proportion of the 49.97% (cross point 1) increase in income is required to even out this inequality compared to that of the spillover group with a proportion of 3.15% (cross point 2) income increase needed to even out the income inequality. At cross point 2, a proportion of 8.78% income increase is needed to eliminate the income disparity among the beneficiary group (cross point 3) compared to the spillover group, which needs 16.22% (cross point 4), thus indicated that after a defined period, the income increase needed to even out the inequality in the beneficiary group plummeted compared to that of the spillover group. To sum up, it can be inferred that in the long run the programme had a significant impact on reducing the income inequality of the

beneficiary group against that of the spillover group. To go into more detail, the results suggest that, in the long run, the NEAZDP significantly reduced the income inequality within the beneficiary group, as the income increase required to eliminate the inequality decreased more sharply compared to that of the spillover group. This indicates that the programme's direct intervention had a lasting and substantial impact on reducing this inequality among the beneficiaries, outperforming the spillover effects over time.

On the other hand, between the beneficiary and control groups, income inequality across the cross points dominates in the control group compared to the beneficiary group. At cross point 1, the beneficiary group needs an 82.91% increase in income to eliminate income disparity, compared to the control group, which needs an 86.31% (cross point 2) income increment to escape income disparity. However, in the long run, the beneficiary group needs an 89.29% (cross point 3) income increase to contain inequality, compared to the control group, which needs a 94.96% (cross point 4) income increase to contain income disparity. Therefore, it can be inferred that the programme has an impact on containing income disparity among the beneficiary group. Delving further into the details, the results indicate that the NEAZDP effectively reduced income inequality in the beneficiary group compared to that of the control group, as evidenced by the lower income increase needed to eliminate disparity over time. This highlights the programme's positive impact on containing and reducing income inequality among the beneficiaries, especially in the long run.

Table 4. Inequality dominance

Crossing	Value of Lambda	Standard Error	Case
		Beneficiary vs. Spillover	
1	0.49965179	0.11556946	1
2	1.03148174	0.55949485	2
3	1.08775437	0.57506090	1
4	1.16233313	0.55160602	2
		Beneficiary vs. Control	
1	0.82908499	0.67246474	1
2	0.86313379	0.64053851	2
3	0.89288998	0.64757412	1
4	0.94963658	0.74674018	2

Note: Case #1 = Before, Distribution #1 Dominates Distribution #2; Case #2 = Before, Distribution #2 Dominates Distribution #1.

Source: Field survey, 2022.

Influence of NEAZDP on Beneficiaries' Social Welfare

At the weighted per-household total income, the Atkinson's social welfare results show that for a better social welfare status vis-à-vis the beneficiary, spillover and control groups, respectively, their income thresholds should be ₦194, 788.99 , ₦204, 614.24 and ₦162, 619.55 (Table 5a). In contrast, at the per capita income, to achieve a better social welfare status, the income threshold of the beneficiary, spillover and control groups, respectively, should be ₦16, 438.23 , ₦14, 828.49 and ₦13, 124.83. It is noteworthy that, at the weighted per-household total income, the social welfare threshold of the beneficiary group is higher than that of the control group but lower than that of the spillover group. Conversely, at the per capita income, the social welfare threshold of the beneficiary was

higher than that of both the spillover and control groups. Therefore, it can be inferred that the programme had an influence on the social welfare of the beneficiaries at the per capita income; however, at the weighted per-household total income level, the presence of the transient spillover effect diffused the influence of the programme. Nevertheless, at the weighted per-household total income, to attain a comfortable social welfare status, the incomes of the beneficiary, spillover and control groups, respectively, should be ₦202, 911.90 , ₦213, 095.74, and ₦171, 890.28. Likewise, at the per capita income, for a comfortable social welfare status, the incomes of the beneficiary, spillover and control groups should be ₦17, 682.41 , ₦15, 525.25 and ₦13, 947.39, respectively. To sum up, to remain potentially sustainable, the programme should strive towards ensuring that the social welfare status of the beneficiaries is not below the estimated threshold income value. At the weighted per-household total income, the inequality in the social welfare status is moderate across all the targeted categories (Table 5a and Figure 2a), whereas at the per capita income, the inequality in the social welfare transits into a high level across the targeted categories, as is evident by their respective inequality estimates (Table 5a and Figure 2b).

Table 5a. Social welfare status

Item	Beneficiary	Spillover	Control
	Per household		
Estimate	0.04003169	0.03980134	0.05393395
	(0.00583345)	(0.00648210)	(0.00561181)
Social Welfare	194788.99121947	204614.24397857	162619.55426933
	(7360.59712107)	(7268.32488765)	(6697.02548870)
Average	202911.89839572	213095.73908469	171890.27632344
	(7939.17409026)	(6881.69787100)	(7137.41721926)
	Per capita		
Estimate	0.07037494	0.04489557	0.05897574
	(0.01754878)	(0.00654051)	(0.00699820)
Social Welfare	16438.22680627	14828.49817274	13124.83088712
	(826.79630870)	(550.03751826)	(558.08670597)
Average	17682.64166667	15525.52554745	13947.38848921
	(1088.93559288)	(554.28463897)	(615.55571024)

Notes: Value in ( ) is the standard error; the estimate refers to inequality index as defined by Atkinson model.

Source: Field survey, 2023.

The findings suggest that the NEAZDP should tailor its income support strategies differently based on whether they target households or individuals (per capita). For households, focusing on lifting incomes above the identified threshold for a better social welfare status is crucial, ensuring that the beneficiaries surpass the control groups and minimising the spillover effects. Meanwhile, for the per capita incomes, the interventions need to raise these individual incomes sufficiently to achieve higher social welfare thresholds relative to both the spillover and control groups. Understanding these thresholds will help the NEAZDP to gauge the effectiveness of its interventions. By aligning the income targets with these benchmarks, the programme can more effectively measure and communicate its impact on enhancing social welfare among the beneficiaries in the study area. Beyond this, strategies that address household-level economic empowerment may lead to more sustainable and equitable outcomes for the beneficiaries, aligning with local

socio-economic dynamics and ensuring broader community impact in the study area. This approach would ensure that resources are allocated where they can most significantly improve household and individual well-being, contributing to sustainable development outcomes.

Table 5b presents an impact assessment of both monetary and fiscal policy on the social welfare of the beneficiary and non-beneficiary groups. Empirically, at the weighted per-household income, it was observed that food inflation significantly affected the social welfare status of both the beneficiary and non-beneficiary groups. Likewise, at per capita income, food inflation significantly affected the social welfare status of both the beneficiary and non-beneficiary groups. To be succinct, at the weighted per-household total income level, a percentage change (increase) in food inflation will decrease the social welfare statuses of the beneficiary, spillover and control groups by ₦305.44, ₦178.71 and ₦215.71, respectively. At the per capita income, a percentage change (increase) in food inflation will decrease the welfare of the beneficiary, spillover and control groups, respectively, by ₦24.95, ₦13.37, and ₦21.55. Thus, it can be inferred that the impact of food inflation is felt more by the beneficiary group compared to the non-beneficiary group. Nonetheless, at both the weighted per-household total income and per capita income, food inflation significantly increases the inequality in social welfare across the targeted groups (Figures 2c and 2d).

These findings highlight critical challenges for the NEAZDP's beneficiaries in Yobe State. Food inflation significantly diminishes social welfare for both the beneficiaries and non-beneficiaries, impacting their economic stability and well-being. The observed increases in inequality underscore the urgency for the NEAZDP to implement targeted measures that not only mitigate the immediate effects of food price hikes, but also address the underlying disparities. Strategies should focus on bolstering resilience against inflationary pressures and promoting inclusive growth, ensuring that vulnerable groups are protected and able to sustain improvements in their socio-economic conditions despite economic fluctuations.

Though inversely related, at both the weighted per-household total income and per capita income, the tax reform (fiscal policy) had no significant impact on the social welfare of either the beneficiary and non-beneficiary (spillover and control) groups (Table 5b). One possible reason is attributed to the poor tax administration in a typical rural economy that is characterised by subsistence livelihood activities. These results suggest that the NEAZDP's beneficiaries in Yobe State may not benefit significantly from tax reform as a means to improve their social welfare. The poor tax administration in rural areas focused on subsistence livelihoods limits the effectiveness of fiscal policies. Therefore, the NEAZDP should prioritise alternative strategies, such as direct income support, agricultural development programs, and/or infrastructure investments tailored to the needs of rural communities. This approach would ensure that efforts to enhance social welfare are more directly impactful and aligned with the economic realities and challenges faced by the beneficiaries in the study area.

Table 5b. Impacts of price change and tax reform on welfare

Item	Beneficiary	Spillover	Control
Per household		Impact of price change	
Impact on Inequality	0.00010537	0.00005512	0.00014299
	(0.00001397)	(0.00001130)	(0.00002432)
Impact on Welfare	−305.44293427	−178.71102053	−215.71422123
	(11.03405442)	(4.92275481)	(9.62770729)
Impact on Mean	−295.90725231	−173.88511497	−202.03180019
	(49.78740244)	(25.95935354)	(29.85554952)
Per capita			
Impact on Inequality	0.00012626	0.00005415	0.00009478
	(0.00002082)	(0.00001180)	(0.00003501)
Impact on Welfare	−24.95093472	−13.37134249	−21.55103421
	(0.96513282)	(0.45754253)	(1.99883305)
Impact on Mean	−24.43816667	−13.11970803	−21.49690647
	(1.86513282)	(1.86717865)	(3.60203462)
Per household		Impact of tax reform	
Impact on Inequality	0.00002147	−0.00000780	0.00001335
	(0.00001298)	(0.00001272)	(0.00003961)
Impact on Welfare	−4.35607951	1.66230771	−2.29429859
	(17.23269947)	(10.91537788)	(20.92017456)
Impact on Mean	0.00000000	0.00000000	0.00000000
	(0.00000000)	(0.00000000)	(0.00000000)
Per capita			
Impact on Inequality	0.00001016	−0.00001634	0.00001967
	(0.00001675)	(0.00001280)	(0.00006410)
Impact on Welfare	−0.17961040	0.25368648	−0.27433952
	(1.28804351)	(0.78964633)	(3.01564418)
Impact on Mean	0.00000000	0.00000000	0.00000000
	(0.00000000)	(0.00000000)	(0.00000000)

Notes: Value in ( ) is the standard error.

Source: Field survey, 2023.

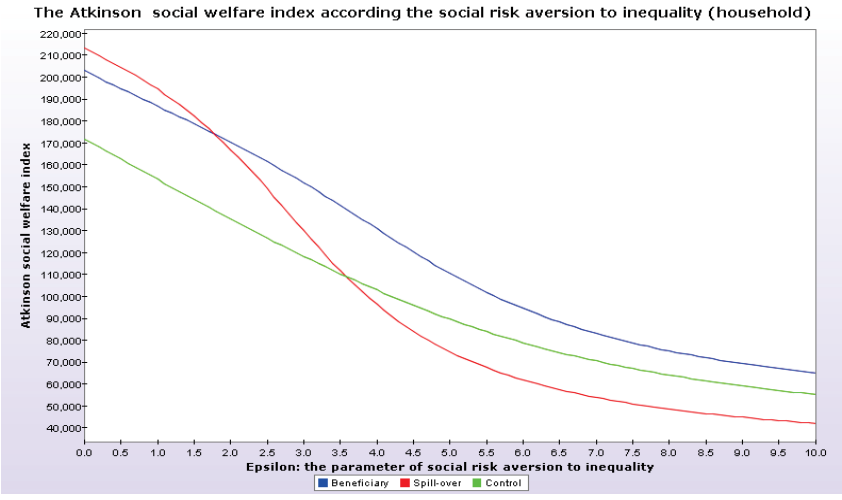

Fig. 2a. Social welfare (per household)

Source: Authors' own research.

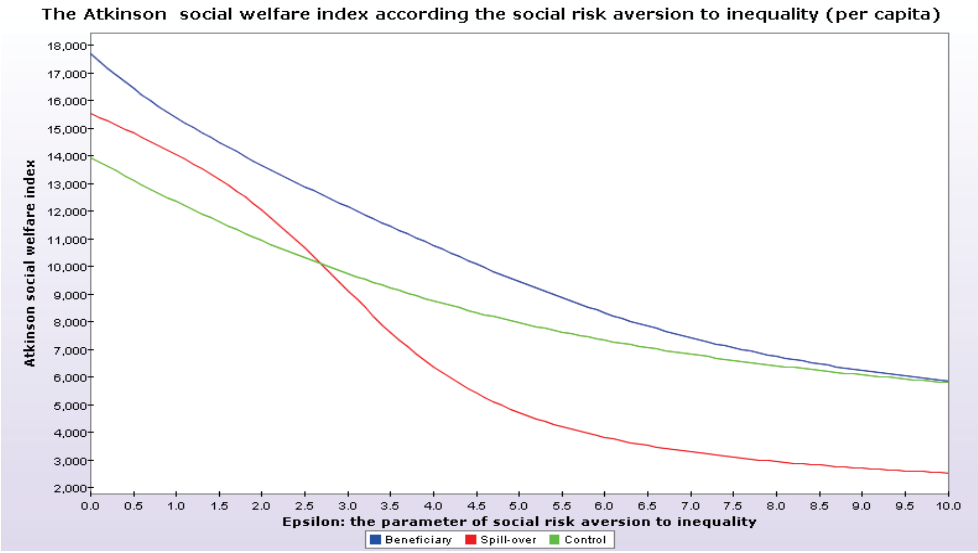

Fig. 2b. Social welfare (per capita income)

Source: Authors' own research.

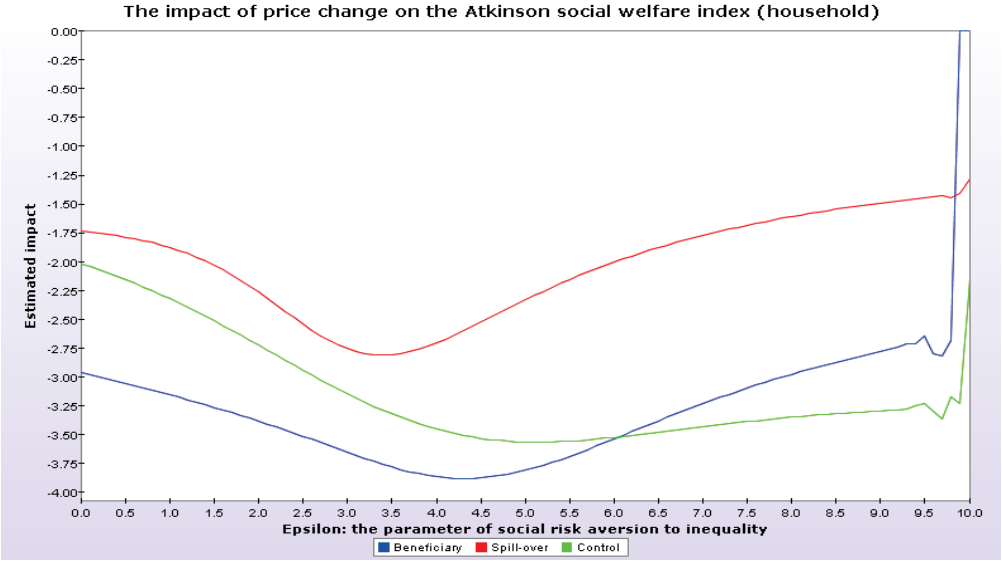

Fig. 2c. Impact of price change (per household)

Source: Authors' own research.

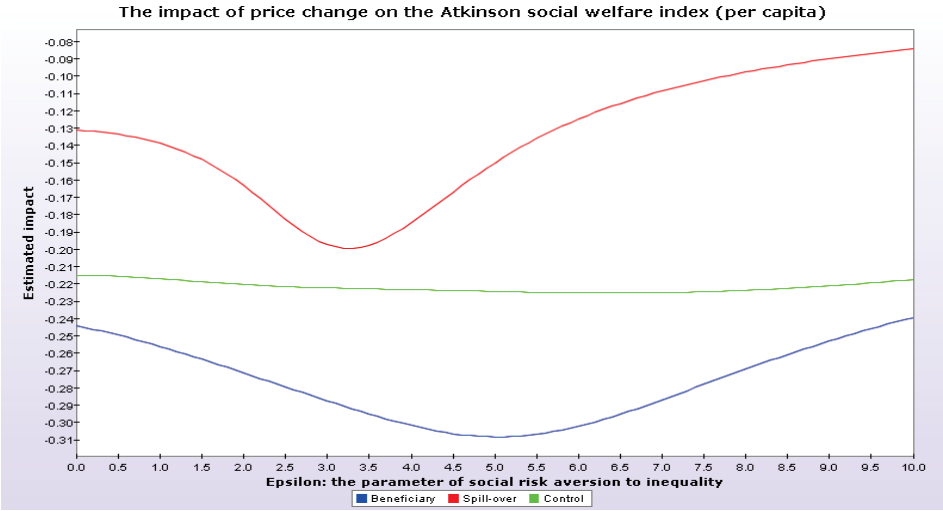

Fig. 2d. Impact of price change (per capita income)

Source: Authors' own research.

Impact of NEAZDP on Change in Social Welfare of Beneficiaries

In analysing the decomposition of the change in social welfare between the beneficiary group and the spillover group (Table 6), the results showed a low inequality across both groups; however, the state of the welfare inequality of the beneficiary group is marginally above that of the spillover group. In contrast, the welfare threshold of the beneficiary is marginally higher (₦589.63) than that of the spillover group; likewise, at the mean level, the welfare of the former supersedes (₦768.86) that of the latter. More so, for the distinction in welfare, the mean and interaction components positively contributed to the margin of lead against the inequality component, which tends to decrease the margin of the lead. Thus, it can be inferred that the programme has a significant impact on changing the social welfare of the beneficiary group. A more nuanced look at the results implies that while both groups have low welfare inequality, the NEAZDP beneficiaries experienced slightly higher welfare levels, as shown by the marginally higher welfare threshold and mean welfare compared to the spillover group. This suggests that the programme's interventions not only reduced the inequality but also improved the overall welfare among the beneficiaries.

On the other hand, between the beneficiary versus control groups, the income inequality across both groups is low; however, the former has a low status compared to that of the latter (Table 6). Likewise, the threshold welfare status and mean welfare status of the beneficiary group are substantially higher than that of the control group, thus a clear indication of the robust impact of the programme on the social welfare of the beneficiary group. Besides this, regarding the distinction in the welfare margin of lead in favour of the beneficiary group, the inequality and mean components had a positive effect on the margin of the lead, while the interaction effect had a negative effect on the welfare margin of the lead. Therefore, it can be inferred that the programme had a significant impact on changing

the social welfare of the beneficiary group. A more nuanced look shows that the results suggest that while the income inequality is low across both groups, the NEAZDP had a significant and positive impact on the welfare of the beneficiary group, as evidenced by its higher welfare status compared to the control group. The positive effects of the inequality and mean components on the welfare underscore the programme's effectiveness, though the negative interaction effect indicates that further efforts are needed to address disparities in the interaction factors to fully optimise the welfare outcomes.

Table 6. Change in social welfare (decomposition)

Index	Distribution 1	Distribution 2	Difference	Covariance
		Beneficiary vs. Spillover		
Inequality	0.05075704	0.04102359	0.00973345	−0.00001159
	(0.00855743)	(0.00223284)	(0.01006934)	
Welfare	14403.10839482	13813.48180188	589.62659294	−266585.90658850
	(958.51827326)	(458.58666988)	(1289.27531084)	
Mean	15173.25805071	14404.40209970	768.85595100	147.67899668
	(1146.55832930)	(511.74325559)	(1512.67039096)	
		Beneficiary vs. Control		
Inequality	0.05075704	0.06515148	−0.01439444	−0.00002255
	(0.00855743)	(0.00623597)	(0.01253828)	
Welfare	14403.10839482	11545.50347737	2857.60491746	−291435.39601352
	(958.51827326)	(719.65446510)	(1421.10190392)	
Mean	15173.25805071	12350.13292712	2823.12512359	−218.40851095
	(1146.55832930)	(852.19043066)	(1693.05801253)	

Notes: Value in ( ) is the standard error.
Source: Field survey, 2023.

Table 7. Continued …….

Welfare: Dist. 2 – Dist. 1	Inequality Component	Mean Component	Interaction
		Beneficiary vs. Spillover	
−589.62659294	147.67899668	−729.83154879	−7.48315080
(1289.27531084)	(163.78131253)	(1429.55593082)	(22.44171148)
		Beneficiary vs. Control	
−2857.60491746	−218.40851095	−2679.83179022	40.63690966
(1421.10190392)	(175.67236883)	(1585.66374110)	(11.02848902)

Notes: Value in ( ) is the standard error.
Source: Field survey, 2023.

Conclusion and recommendations

The NEAZDP program has positively impacted the socio-economic development, income inequality reduction, and social welfare improvement of the beneficiaries, particularly in enhancing food security, asset acquisition, and per capita income. However, spillover effects in non-beneficiary groups highlight the importance of socio-economic endowments in achieving equitable outcomes. Despite these gains, food inflation significantly diminishes social welfare and exacerbates inequality, indicating the need for more targeted interventions. Consequently, it is recommended that the NEAZDP should:

1. Targeted support for income stability: NEAZDP should prioritise strategies that raise income levels above the identified thresholds for both households and individuals to sustain improvements in socio-economic conditions.
2. Mitigating food inflation: NEAZDP should implement measures to combat the adverse effects of food inflation on its beneficiaries, such as price stabilisation mechanisms and/or support for food production to enhance resilience.
3. Addressing inequality: tailor interventions to address internal disparities within the beneficiary group by providing targeted support for marginalised and disadvantaged sub-groups.
4. Long-term economic empowerment: NEAZDP should promote sustainable economic activities, such as livelihood diversification and market access, to ensure lasting improvements in social welfare.
5. Improving social services: NEAZDP should invest in education, healthcare, and infrastructure to complement the economic gains and provide a holistic approach to enhancing social welfare and reducing inequality in the region.

References

Adams, R.H., Page, J. (2005). Do international migration and remittances reduce poverty in developing countries? *World Development*, 33(10), 1645-1669.

Adewuyi, A.O., Ogebe, P.O. (2019). Rural infrastructure development and poverty alleviation in Nigeria. *Journal of Infrastructure Development*, 11(2), 105-120.

Aruofor, R.O., Ogbeide, D. (2024). An Escalating Analysis of the Role, Impact and Ramification of Investment in the Nigerian Economy and Outlook to Year 2035. PDF Link

Ayanwale, A.B., Adekunle, A.A., Kehinde, A.D., Fatunbi, O.A. (2024). Networking and Training for Improvement of Farm Income: A Case of Lifelong Learning (L3F) Approach in West Africa. PDF Link

Beegle, K., Christiaensen, L., Dabalen, A., Gaddis, I. (2016). Poverty in a rising Africa. Washington, DC: The World Bank.

Bigsten, A. (2024). Atkinson on Inequality. Inequality: Economic and Social Issues, 95-111.

Chinyoka, I. (2023). Ending poverty on the African continent: consolidating the agrarian welfare regime in Zimbabwe. In: Poverty, Inequality, and Innovation in the Global South (pp. 285-306). Cham: Springer International Publishing.

Deininger, K., Squire, L. (1998). New ways of looking at old issues: Inequality and growth. *Journal of Development Economics*, 57(2), 259-287.

Ellis, F., Biggs, S. (2001). Evolving themes in rural development 1950s–2000s. *Development Policy Review*, 19(4), 437-448.

Idiku, F.O. (2024). Response of Rural Farmers to the Effects of Climate Change in Cross River State Nigeria.

Kanbur, R., Squire, L. (1999). The evolution of thinking about poverty: Exploring the interactions. In G. Meier & J. Stiglitz (Eds.), Frontiers of Development Economics: The Future in Perspective (pp. 183-226). New York: Oxford University Press.

Komolafe, M.A., Ayodele, K.P., Olaogun, M.O.B. (2024). Africa Region: Nigeria.
Madaki, M.J., Owoade, E.O., Hassan, B.K., Muhammed, H.K. (2024). Assessing climate change perceptions and adaptation strategies among sesame farmers in Yobe State, Nigeria. *Asian Research Journal of Agriculture*, 17(2), 309-317.
Madu, I.A. (2010). The structure and pattern of rurality in Nigeria. *GeoJournal*, 75(2), 175-184.
Musa, U.F., Mohammed, S.U. (2024). Perceptions of Care-givers on the Phenomenon of Child Poverty in Bauchi State of Nigeria.
Nechifor, V., Ramos, M. P., Ferrari, E., Laichena, J., Kihiu, E., Omanyo, D., Musamali, R., Kiriga, B. (2021). Food security and welfare changes under COVID-19 in Sub-Saharan Africa: Impacts and responses in Kenya. *Global Food Security*, 28, 100514.
Ogbonna, S., Oji, E. (2020). Rural development policies and strategies in Nigeria: The missing gaps. *International Journal of Scientific and Engineering Research*, 11(6), 1456-1470.
Oyedepo, J.A., Irekhore, O.T., Bello, K.O., Olaoye, O.J., Lala, A.O., Oluwalana, E.O., Oyedepo, E.O., Omotayo, A.M. (2020). Livelihood Support Programmes for Sustainable Development Goals in Rural Nigeria. Sustainable Development Goals and Institutions of Higher Education, 155-168.
Ravallion, M. (2009). A Comparative Perspective on Poverty Reduction in Brazil, China, and India. *World Bank Research Observer*, 24(1), 71-104.
Sadiq, M.S., Singh, I.P., Ahmad, M.M. (2020). Rice yield differentials between IFAD participating and Non-Participating farmers in Nigeria's Niger state. *Economic Affairs*, 65(4), 559-573.
Sadiq, S., Sani, B.S. (2024). Inequality and social welfare status of paddy rice processors in Nigeria's Jigawa State. *Sustainability, Agri, Food and Environmental Research*, 12(2).
Salifu, A., Kufoalor, K.M. (2024). Are cash transfer programmes effective at targeting people experiencing poverty in Sub-Saharan Africa? *SN Business & Economics*, 4(2), 24.
Sam, A.G., Abidoye, B.O., Mashaba, S. (2021). Climate change and household welfare in sub-Saharan Africa: empirical evidence from Swaziland. *Food Security*, 13(2), 439-455.
Schmidt, E., Pacek, A.C., Radcliff, B. (2024). The Welfare State and Human Well-Being Around the World: A Cross-National Analysis. *Applied Research in Quality of Life*, 19(1), 365-380.
Shikur, Z.H. (2020). Agricultural policies, agricultural production and rural households' welfare in Ethiopia. *Journal of Economic Structures*, 9(1), 50.
Singh, S.V.P., Shrotryia, V.K. (2022). Income Inequality and Human Wellbeing: An Empirical Analysis Using Atkinson Measure of Inequality. *Emerging Economy Studies*, 8(2), 116-128.
Teka, A., Lee, S.K. (2020). Do agricultural package programs improve the welfare of rural people? Evidence from smallholder farmers in Ethiopia. *Agriculture*, 10(5), 190.
Thorbecke, E. (2013). The interrelationship linking growth, inequality, and poverty in Sub-Saharan Africa. *Journal of African Economies*, 22(suppl_1), i15-i48.
Ucha, C. (2010). Poverty in Nigeria: Some dimensions and contributing factors. *Global Majority E-Journal*, 1(1), 46-56.
Umar, M.B. (2024). Climate change awareness, perception, and adaptation strategies for small and marginal farmers in Yobe State, Nigeria. In: Sustainability of Natural Resources (pp. 148-163). CRC Press.
United Nations Development Programme (UNDP) (2018). Human Development Indices and Indicators: 2018 Statistical Update. New York: UNDP.
Warinda, E.M., Nyariki, D., Wambua, S., Muasya, R. (2020). Impact of smallholder farmers' welfare through participation in on-farm regional projects in East Africa. *Agrekon*, 59(1), 16-29.
World Bank. (2007). Agriculture for Development. World Development Report 2008. Washington, DC: The World Bank.
Zou, H. (2024). The social welfare effect of environmental regulation: An analysis based on Atkinson social welfare function. *Journal of Cleaner Production*, 434, 140022.

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